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EXAMINER

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/711,298
Filing Date: September 09, 2004
Appellant(s): IWATAKE ET AL.

Yuanmin Cai
Reg. No. 56,513
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed September 6, 2006 appealing from the Office action mailed April 13, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,094,981	Chung et al.	3-1992
JP-08-107087	Osaki	4-1996

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 4 and 5 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 4 recites: the via contact structure as claimed in claim 3, wherein said *first metal* and said *second metal* are the same.

Firstly, in the Remarks to claim objection paper number 04/06/2006, the Appellant clearly stated: "In amended claim 1, "first metal" refers to metal element in layer 103 (p.8, line 14) and "second metal" refers to metal element in layer 106 (p.9, line 13). In other words, "first metal and second metal" refer to **different metal element**, as opposed to same metal 106 as alleged by the Examiner". (Paragraph linking p. 5/8 and p. 6/8). (Emphasis added).

By the Appellant's own admission, the first metal and the second metal are **not** the same.

Therefore, claim 4 is indefinite.

Claim 5 recites: the via contact structure as claimed in claim 3, wherein said first metal consists essentially of cobalt and said second metal consists essentially of titanium.

However, as indicated in the specification and according to the remarks, the first metal is a silicide (103), thus, *not consists essentially of cobalt*. Similarly, the second metal comprises two portions, the bottom portion (108) is a silicide, while the sidewall portion (106) comprises non-silicided metal, thus *not consists essentially of titanium*.

Therefore, claim 5 is also indefinite.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-5 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Chung et al. (U.S. Patent No. 5,094,981).

With respect to claim 1, Chung teaches a via contact structure having a via contact to a diffusion region (18) at a top surface of a substrate (10) as claimed, the via contact structure includes:

a first layer (42c) consisting essentially of a silicide of a first metal in contact with the diffusion region (18) at the top surface;

a dielectric region (32) overlying the first layer (42c), the dielectric region (32) having an outer surface and an opening extending from the outer surface of the dielectric region (32);

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a second layer (34) lining the opening and contacting the top surface in the opening, the second layer (34) including a second metal lining a sidewall of the opening and a silicide of the second metal self-aligned to the top surface in the opening;

a diffusion barrier layer (36) overlying the second layer (34) within the opening; and

a third layer (40c) including a third metal overlying the diffusion barrier layer (36) and filling the opening. (See Fig. 2d).

Product by process limitation:

The expression “an opening extending from said outer surface through said first layer to said top surface of said substrate” is/are taken to be a product by process limitation and is given no patentable weight. A product by process claim directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See *In re Fessman*, 180 USPQ 324, 326 (CCPA 1974); *In re Marosi et al.*, 218 USPQ 289, 292 (Fed. Cir. 1983); *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); *Buono v. Yankee Maid Dress Corp.*, 77 F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935); and particularly *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make it clear that it is the patentability of the final structure of the product “gleaned” from the process steps, which must be determined in a “product by process” claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old and obvious product produced by a new method is not a patentable product, whether claimed in “product by process” claims or not.

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Note that Applicant has burden of proof in such cases as the above case law makes clear.

Insofar as the structure is concerned, a silicide layer is present at the bottom of the via and contacting the substrate. The newly added limitation is clearly directed to a process, thus, no patentable weight is given.

With respect to claim 2, the first metal (42c) of Chung is selected from the group consisting of cobalt (Co), molybdenum (Mo), tantalum (Ta), titanium (Ti) and tungsten (W).

With respect to claim 3, the second metal (34) of Chung is selected from the group consisting of titanium (Ti).

With respect to claim 4, the first metal and the second metal of Chung are the same (Ti).

With respect to claim 5, the first metal (42c) of Chung consists essentially of cobalt and second metal (34) consists essentially of titanium.

With respect to claim 8, the third metal (40c) of Chung includes tungsten (W).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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3. Claims 6, 7, 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chung as applied to claim 1 above, and further in view of Osaki (JP. Patent No. 08-107087) of record.

With respect to claims 6 and 7, Chung teaches a via contact structure having a via contact including a diffusion barrier layer (36).

Thus, Chung is shown to teach all the features of the claim with the exception of explicitly utilizing metal nitride for the barrier layer.

However, Osaki teaches a similar contact structure including: utilizing titanium (metal) nitride for the diffusion barrier layer (56) to function as a barrier layer.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the via contact structure of Chung utilizing titanium nitride for the barrier layer as taught by Osaki because titanium nitride or titanium-tungsten material are well known in the art to be used as barrier layer.

Furthermore, it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416., 125 USPQ 416.

With respect to claim 9, in view of Osaki, the opening (54) has a width (0.6 μm or less) which includes the claimed range (of about 250 nm or less) and a height-to-width aspect ratio greater than one.

With respect to claim 10, the aspect ratio value of Osaki is about 2.5 which encompasses the claimed range.

(10) Response to Argument

Claims rejected under 35 U.S.C 112, second paragraph:

The Appellant states:

The Examiner's statements that "the first metal is a silicide" and "the first metal and the bottom portion of the second metal are silicide" are technically incorrect and have no merit. *The fact is that a metal is a metal and not a silicide*. In other words, a metal is different from a silicide. *Claiming a metal is a silicide is simply baseless*. On the other hand, a silicide may be formed from metals and silicon and therefore may comprise of metals. A person of ordinary skill will understand that a first metal or a first metal that forms a first silicide may be the same or different from a second metal or a second metal that forms a second silicide. (Emphasis added).

The Appellant appears to argue about the method leading to the device, however, the claimed invention are clearly directed to an apparatus. As a device, the material should be considered as a whole not compartmentalize. As a silicide (silicide is an alloy of metal and silicon), layer 103 can not be seen only as a metal but a combination of metal and silicon.

Therefore, the claimed "first layer" have to be considered as a *silicide*, not singly as "metal".

"Second layer" on the other hand, clearly comprises two portions, bottom portion (108) is a silicide and the sidewall portion (106) is a metal.

By claiming: "wherein the first metal and said second metal are the same", the Appellant contradicting his own admission in the Remarks, paper number 04/06/2006, (e.g., first metal and second metal" refer to **different metal element**).

Secondly, since the second layer comprises two portions, metal only portion and silicide portion, therefore, it is not known which portion is the same as the first layer.

Therefore, claim 4 is indefinite.

The Appellant further adds:

Claims 4 and 5 depend from claim 1, therefore the first metal (that forms the silicide of the first layer) and the second metal (that forms a sidewall portion and the silicide of a bottom portion of the second layer) may be the same. In addition, the first and/or second metal may consist essentially of cobalt, titanium, or any other metals. In other words, it will be baseless to argue that the first and second metals may not be the same and may not consist essentially of cobalt, titanium, or any other metals.

As discussed in the rejection, the first layer is a silicide, silicide is well known in the art to include metal and silicon. By claiming "said first metal consists essentially of cobalt and said second metal consists essentially of titanium", the Appellant has excluded silicon in the silicide structure, which is contradicting the disclosure.

Therefore, claim 5 is indefinite.

Rejection under 35 U.S.C 102:

Appellants' arguments are as follows:

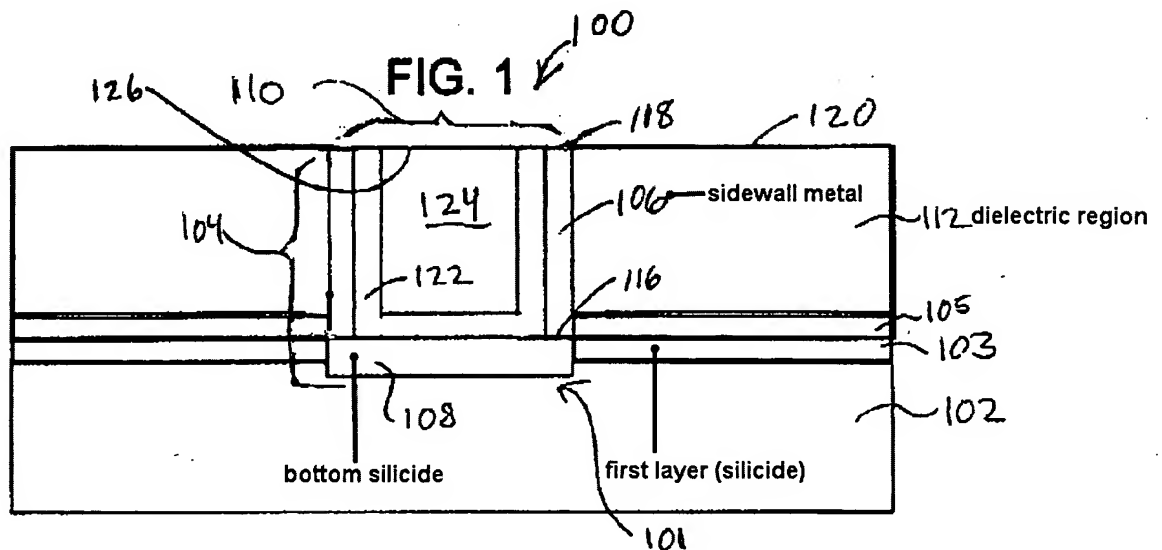
The Examiner's allegation that the "expression" is a product-by-process limitation is totally baseless without merit. *The "expression" clearly describes how a final structure of the present invention, according to one embodiment, may look like.* That is, the final structure of the present invention may have an opening, which is part of the structure and is described by the

"expression", wherein a via contact, according to one embodiment of the present invention, is formed. Appellants assert that in no way may the "expression" be interpreted as describing a process or a method of making the opening, or a process or a method of making the structure of the present invention. (Emphasis added).

The Appellant appears to contend that *the "expression" clearly describes how a final structure of the present invention, according to one embodiment, may look like.*

However, insofar as the structure is concerned, the claimed via structure, which is reproduced Fig. 1 below, does not have "an opening extending from said outer surface through said first layer to said surface of said substrate" (claim 1, lines 6-7).

By claiming "an opening" the Appellant apparently claimed the process steps as shown in Fig. 4.



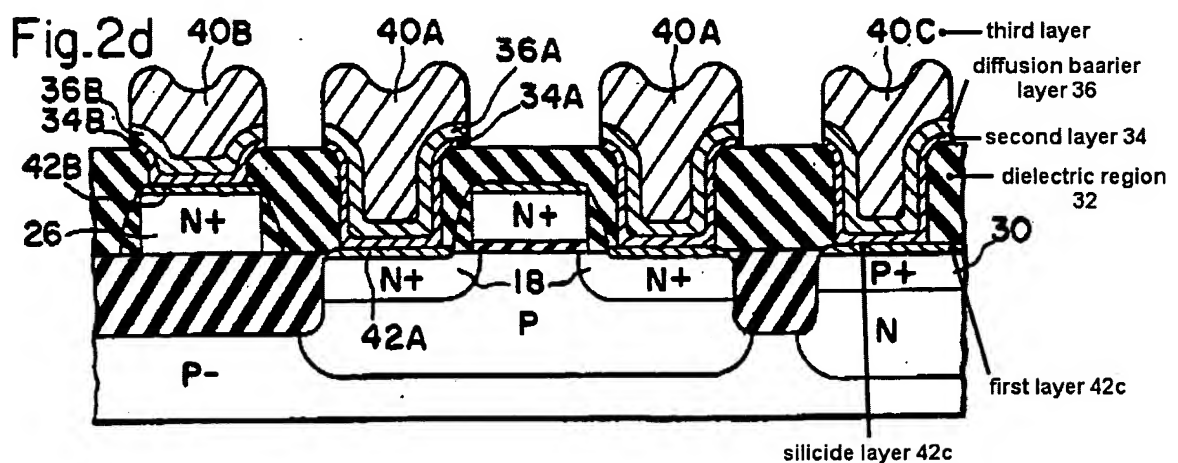
The final structure as shown above does not have any opening at all. What ever was formed previously, during the process, had been filled by the contact materials.

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As shown above, the instant via structure includes: a silicide layer 108 formed on the substrate 102; a metal layer 106 formed on the sidewalls; a diffusion barrier layer 122 overlying the silicide layer 108 and sidewall layer 106; and a third layer 124 overlying the diffusion barrier layer 122.

By comparison, the via structure, Fig. 2d of Chung reproduced below, shows: a silicide layer 42c formed on and contacting the substrate; a metal layer 34 formed on the sidewalls of the dielectric region 32; a diffusion barrier layer 36 overlying the silicide layer 42c and metal layer 34; and a third layer 40c overlying the diffusion barrier layer 36.

As clearly discussed in the product-by-process of the rejection above, the case laws which make it clear that it is the patentability of the final structure of the product “gleaned” from the process steps, which must be determined in a “product-by-process” claim, and not the patentability of the process.



The Appellant further argues:

Despite the above allegation, the Examiner subsequently contends that Chung describes a second layer lining the *opening* and contacting the top surface (of the substrate) in the *opening*, even though the Examiner fails to show that Chung discloses an opening that extends to the top surface of the substrate. As is clearly shown in FIG. 2d which is specifically cited by the Examiner, the opening of dielectric region (32) does not even extend through layer (42c) to the top surface of substrate (10). Therefore, it is technically impossible for *liner (34) to contact the top surface of substrate (10)* in the opening of dielectric region (32). In other words, the allegation made by the Examiner, that the second layer contacting the top surface (of the substrate) in the opening, is again baseless and without merit. (Emphasis added).

As discussed above, the opening does not exist in the product.

As for the second layer (34) contacting the surface of the substrate, Chung clearly teaches: "After Ti layer 34 and barrier material layer 36 are deposited, the structure appears as shown in Fig. 2c. *Thin titanium silicide layers, not shown in the drawings, may form along the interfaces between Ti layer 34 and silicide layers 42A-42C* during the RTA. (col. 6, ll. 30-35). (Emphasis added).

Since a portion of the layer 34 forms a silicide layer at the interface with another silicide layer 42C, thus, clearly these layers became one, therefore, layer 34 is contacting the substrate by the virtual of it merging with layer 42C.

The instant via contact on the other hand, removing the silicide at the bottom of the contact then replacing it with another silicide of the same material does not differentiate itself from the via contact of Chung which also has a silicide contacting the substrate and metal layer on the sidewall of the dielectric region.

A new process to form a same old product is clearly unpatentable.

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Therefore, claim 1, via structure, is being anticipated by Chung.

Dependent claims 2-10:

The Appellant argues that claims 2-10 depend directly or indirectly from claim 1, and thus patentable at least for the reasons as described above with regard to claim 1.

Since claim 1 is being anticipated by Chung as discussed above, therefore, the dependent claims 2-10 are either being anticipated by Chung or made obvious by Chung and Osaki.

(11) Related Proceeding(s) Appendix

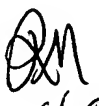
No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Anh D. Mai A.D.M.

Conferees:

Ricky L. Mack, SPE. 

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